TO   :

DATE   : **Aug. 01.2002**

SAMSUNG TFT-LCD

MODEL NO. : LTM170W1-L01

Any Modification of Spec is not allowed without SEC's permission.

Senior manager :

PREPARED BY : AMLCD Technical Customer Service Team

SAMSUNG ELECTRONICS CO., LTD.

wise view™
SAMSUNG TFT-LCD

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Date	Rev.No.	Page	Summary		3 /26
May 23, 2002	000		Preliminary spec of LTM170W1 -L01 model is issued for the first time.		
Aug. 01, 2002	001		Change Point		
		6	Panel MTBF 50000 Hours.		
		12	Lamp frequency 60 -> 70KHz		
		19	T5>=500 -> T5>=100		
		20	Outline Drawing : add wire length & tube length		

GENERAL DESCRIPTION

DESCRIPTION

   LTM170W1-L01 is a color active matrix TFT (Thin Film Transistor) liquid crystal display that uses amorphous silicon TFT switching devices. This model is composed of a TFT LCD panel, a driver circuit and a back-light system. The resolution of 17.0- inch contains 1,280 x 768 pixels and can display up to 16.2 millions colors.

FEATURES

   • High contrast ratio, High aperture structure
   • Wide viewing angle
   • High-speed response
   • WXGA(1280x768 pixels) resolution
   • Low power consumption
   • 4 CCFLs (Cold Cathode Fluorescent Light)
   • DE Only Mode
   • LVDS Interface with 1 pixel / clock

APPLICATIONS

   • Desktop monitors
   • Display terminals for AV application products
   • TV application

GENERAL SPECIFICATIONS

ITEM	SPECIFICATION	UNIT	NOTE
Active area	370.560(H) X 222.336(V)	mm	
Driver element	a-Si TFT active matrix		
Display colors	16.2M		
Number of pixel	1280 x 768	pixel	Wide XGA
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.2895(H) x 0.2895(V)	mm	
Display Mode	Normally white		
Surface treatment	Haze 25 , Anti-glare & Hard - Coating (3H)		

Mechanical Information

ITEM		MIN.	TYP.	MAX.	NOTE
Module size	Horizontal (H)	403.5	404.0	404.5	mm
	Vertical (V)	257.5	258.0	258.5	mm
	Depth (D)	-	16.2	16.7	mm
Weight		-	-	2000	g

1. ABSOLUTE MAXIMUM RATINGS

1.1 ABSOLUTE RATINGS OF ENVIRONMENT

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage temperature	T_{STG}	-20	60	^{O}C	(1),(5)
Operating temperature (Surface of Glass)	T_{OPR}	0	50	^{O}C	(1),(5)
Shock (non-operating)	Snop	-	50	G	(2),(4)
Vibration (non-operating)	Vnop	-	1.5	G	(3),(4)

Note (1) Temperature and relative humidity range are shown in the figure below.
　　　　95 % RH Max. (40 $^{\circ}$C $\geq$ Ta)
　　　　Maximum wet - bulb temperature at 39 $^{\circ}$C or less. (Ta > 40 $^{\circ}$C) No condensation.
　　　(2) 11ms, sine wave, 1 time for $\pm$X, $\pm$Y, $\pm$Z.
　　　(3) 10 - 300 - 10 Hz, Sweep rate: 10 min, 30 min for X,Y,Z.
　　　(4) At testing Vibration and Shock, the fixture in holding the Module to be tested have to be
　　　　 hard and rigid enough so that the Module would not be twisted or bent by the fixture.
　　　(5) If product is used for extended time excessively or exposed to high temperatures for extended time,
　　　　 there is a possibility of wide viewing angle film damage which could affect visual characteristics.

Relative Humidity (%RH)

Operating Range

(40, 95)

(50, 50.4)

(60,27.7)

Storage Range

Temperature (^{O}C)
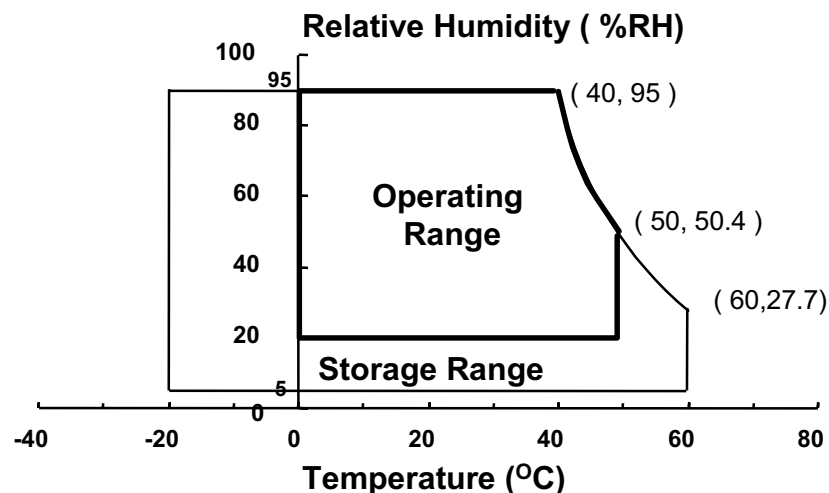
1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD MODULE

(Vss = GND = 0 V)

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage	V_{DD}	GND	4.0	V	(1)

NOTE (1) With Ta ($25 \pm 2\ ^{O}C$)

(2) BACK-LIGHT UNIT

Ta = $25 \pm 2\ ^{O}C$

ITEM	SYMBOL	MIN.	MAX.	UNIT.	NOTE
Lamp current	I_L	3.0	8.0	mArms	(1) (2)
Lamp frequency	f_L	30	80	KHz	(1)

NOTE (1) Permanent damage to the device may occur if maximum values are exceeded. Functional operation should be restricted to the conditions described under Normal Operating Conditions.
  (2) Specified values are for a single lamp

1.3 MTBF(Panel)
50,000 Hours (Except for lamp)
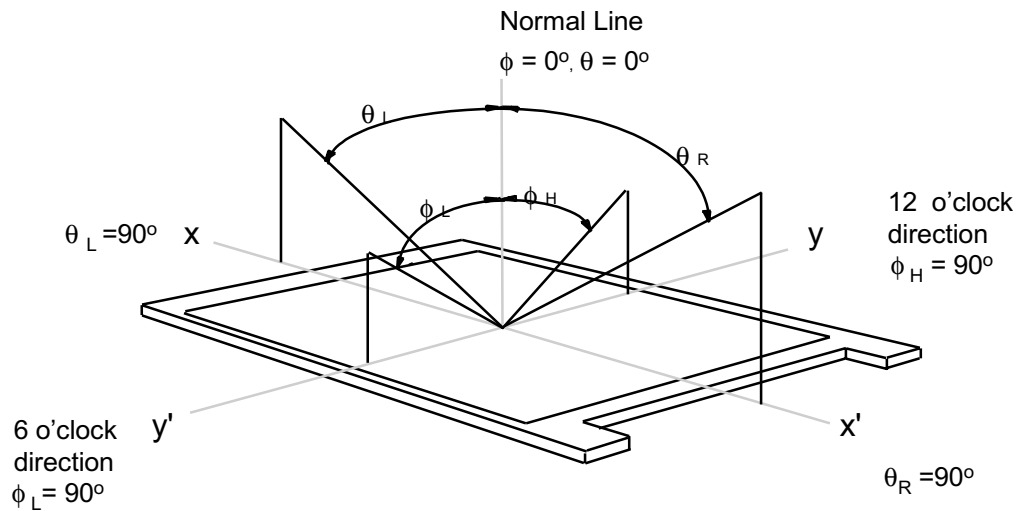
2. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (4).
Measuring equipment : TOPCON BM-5A

* $Ta = 25 \pm 2\,^{\circ}C$, $V_{DD} = 3.3V$,   fv= 60Hz, f_{DCLK}=65MHz, I_L = 7.0 mArms

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Contrast Ratio (Center of screen)		CR	φ = 0, θ = 0 Normal Viewing Angle	350	400	-		(1), (2), (4)
Response Time at Ta	Rising	T_R		-	5	10	msec	(1), (3)
	Falling	T_F		-	20	25		
Luminance of White (Center of screen)		Y_L		400	450	-	cd/m^2	
Color Chromaticity (CIE 1933)	Red	R_X		0.607	0.632	0.657		(1), (4)
		R_Y		0.332	0.357	0.382		
	Green	G_X		0.264	0.289	0.314		
		G_Y		0.571	0.596	0.621		
	Blue	B_X		0.118	0.143	0.168		
		B_Y		0.060	0.085	0.110		
	White	W_X		0.291	0.316	0.341		
		W_Y		0.313	0.338	0.363		
Viewing Angle	Hor.	θ_L	CR ≥ 10	65	70	-	Degrees	
		θ_R		65	70	-		
	Ver.	ϕ_H		45	50	-		
		ϕ_L		55	60	-		
Brightness Uniformity (9 Point)		B_{UNI}		-	-	25	%	(5)

Note 1) Definition of Viewing Angle : Viewing angle range ($10 \leq CR$)

Normal Line
$\phi = 0^o, \theta = 0^o$

θ_L

θ_R

ϕ_L ϕ_H

$\theta_L = 90^o$ x

12 o'clock direction
$\phi_H = 90^o$

y

6 o'clock direction
$\phi_L = 90^o$ y'

x'

$\theta_R = 90^o$

Note 2) Definition of Contrast Ratio (CR) : Ratio of gray max (Gmax) ,gray min (Gmin) at the center point of panel.
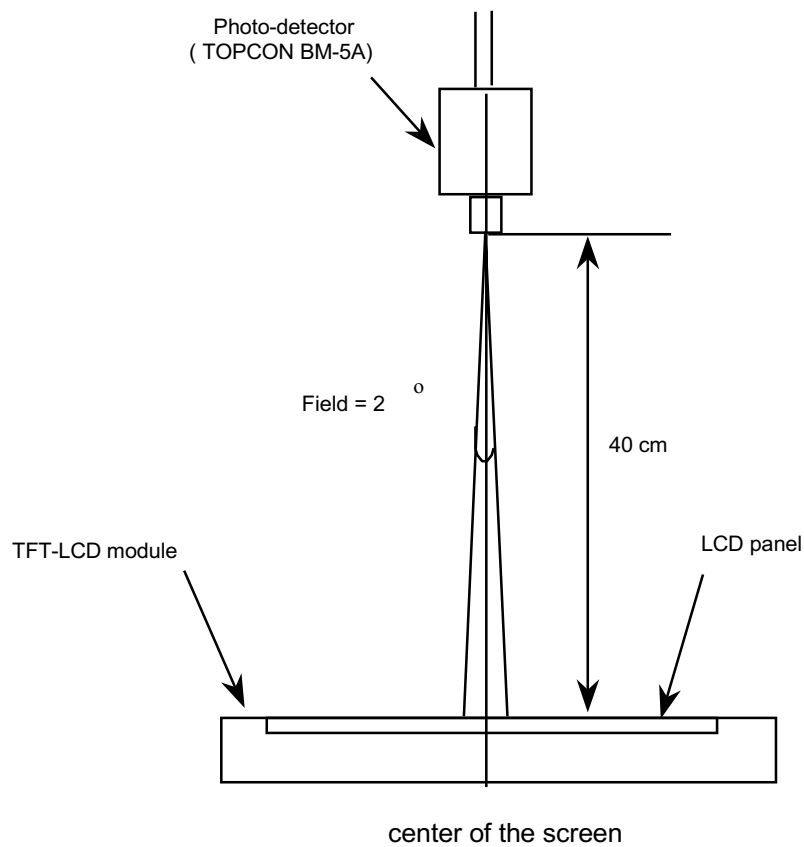
$$CR = \frac{\text{Luminance with all pixels white (Gmax)}}{\text{Luminance with all pixels black (Gmin)}}$$

Note 3) Definition of Response time : Sum of T_R, T_F

Display data   White(TFT OFF)   Black(TFT ON)   White(TFT OFF)

T_R T_F

Optical Response   100%   90%

10%   0%

Time
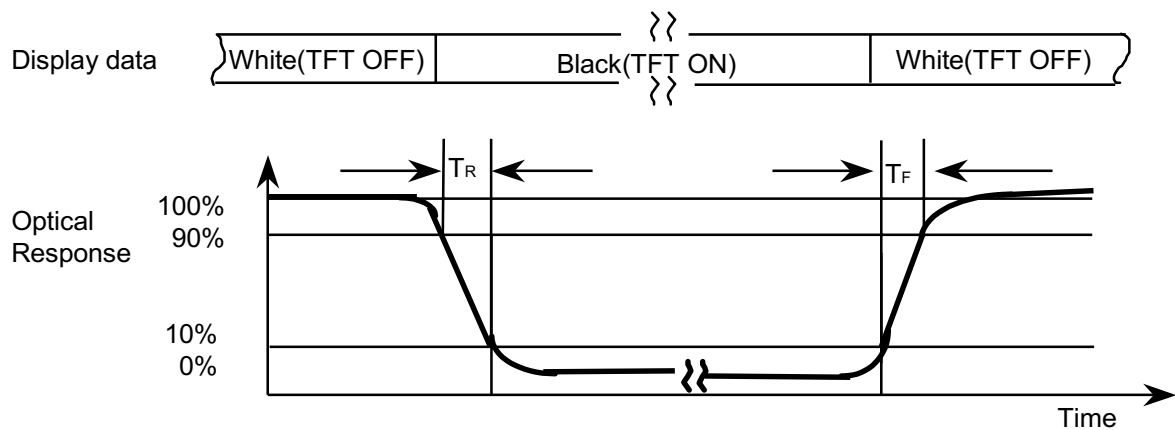
Note 4) After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the back-light. This should be measured in the center of screen.
Lamp current : 6.0mA , Environment condition : Ta = 25 ± 2 °C

Photo-detector
(TOPCON BM-5A)

Field = 2 °
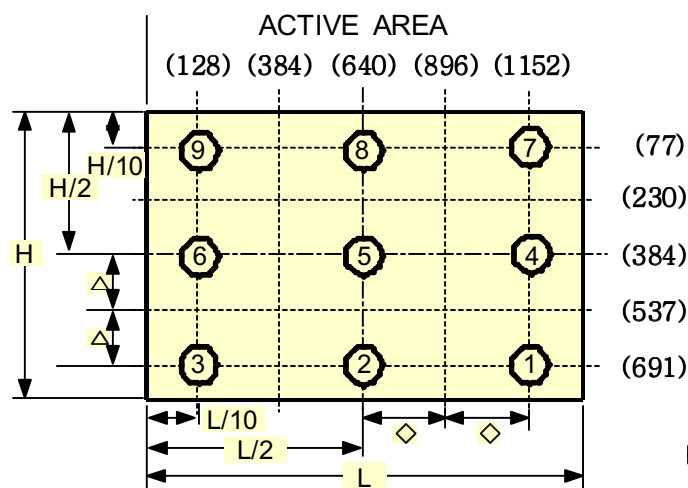
40 cm

TFT-LCD module

LCD panel

center of the screen

Optical characteristics measurement setup

Note 5) Definition of 9 points brightness uniformity

$$Buni = \left| \ 1 - \frac{B\min}{B\max} \ \right| \times 100$$

Bmax : Maximum Brightness

Bmin : Minimum Brightness

ACTIVE AREA

(128) (384) (640) (896) (1152)

H/10

H/2

H

9   8   7   (77)

(230)

6   5   4   (384)

(537)

3   2   1   (691)

L/10

L/2

L

◯ : test point

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Ta= 25 ± 2 °C

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Voltage of Power Supply		V_{DD}	3.0	3.3	3.6	V	(1)
Differential Input Threshold Voltage		V_H	-	-	100	mV	V_{CM} =1.2V
		V_L	-100	-	-	mV	
Current of Power Supply	White	I_{DD}	-	450	-	mA	(2)(4)*a
	Black		-	520	-	mA	(2)(4)*b
	Sparse Dot Morie		-	550	600	mA	(2)(4)*c
Vsync Frequency		fv	-	60	-	Hz	
Hsync Frequency		fH	-	48.4	-	kHz	
Main Frequency		fDCLK	-	68	80	MHz	(3)
Rush Current		Irush	-	-	3.0	A	(5)

Note (1)Vss = 0 V, Input Power Max,Min=Ripple Max,Min

(2) fv=60Hz, fDCLK =65MHZ, V_{DD} = 3.3V, DC Current.
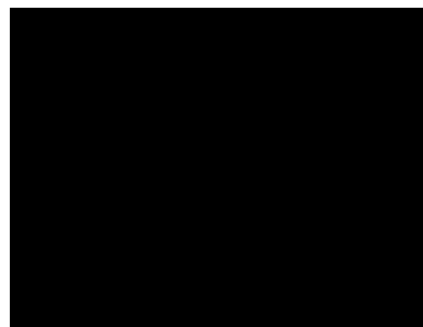
(3) 1 Pixel/clock

(4) Power dissipation check pattern

*a) White Pattern   *b) Black Pattern

VIEW AREA
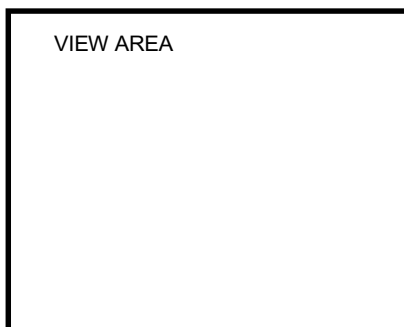
c) Sparse dot Morie Pattern
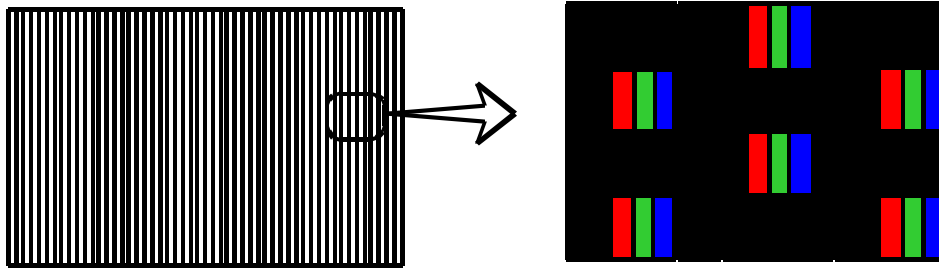
(5) Measurement Conditions

V_{DD} rising time : 470us

INPUT
POWER(3.3V)

2SK1059

Vcc(LCD Input)

TestPoint

47kΩ

CENTREL
SIGNAL

1kΩ

2SK1339

1μF

32kΩ

14V

1μF

0.01μF
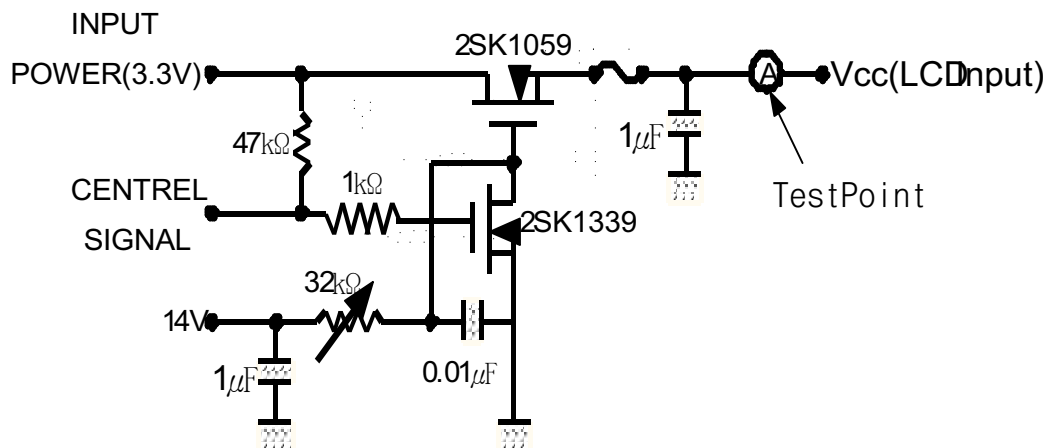
Note : Control Signal : High(+3.3V) -->Low(Ground)

All Signal lines to panel except for power 3.3V : Ground

The rising time of supplied voltage is controlled to 470us by R3 and C2 value.

0.9 V_{DD}   3.3V

GND   0.1 V_{DD}

Rising Time

3.2 BACK-LIGHT UNIT

The back-light system is an edge-lighting type with 4 CCFTs(Cold Cathode Fluorescent Tube).

The characteristics of four lamps are shown in the following tables.

Ta= 25 ± 2 °C

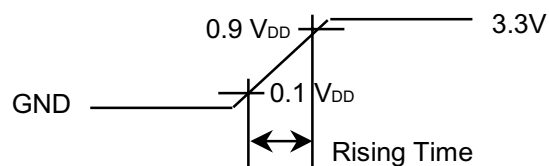| ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Lamp Current	I_L	3.0	7.0	8.0	mA$_{rms}$	(1)
Lamp Voltage	V_L	-	665	-	V$_{rms}$	I_L=7.0 mArms
Lamp Frequency	F_L	40	-	70	kHz	(2)
Operating Life Time of Lamp	Hr	25,000	50,000	-	Hour	(3)
Startup Voltage	Vs	-	-	0°C :1700 / 25°C :1220	Vrms	(4)

Note) The waveform of the inverter output voltage must be area symmetric and the design of the inverter must have specifications for the modularized lamp.

The performance of the back-light, for example life time or brightness, is much influenced by the characteristics of the DC-AC inverter for the lamp. So all the parameters of an inverter should be carefully designed so as not to produce too much leakage current from high-voltage output of the inverter. When you design or order the inverter, please make sure that a poor lighting caused by the mismatch of the back-light and the inverter(miss lighting, flicker, etc.) never occur. When you confirm it, the module should be operated in the same condition as it is installed in your instrument.

Note (1) Lamp current is measured with current meter for high frequency as shown below.
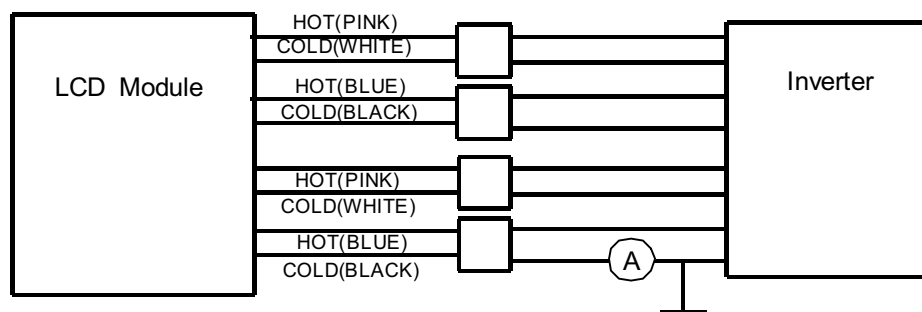
(2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause line flow on the display. Therefore lamp frequency shall be detached from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference.

(3) Life time (Hr) of a lamp is defined
   - as the time in which it continues to operate under the condition of Ta = 25 ± 2 °C and I_L = 7.0 mArms until the brightness becomes 50% or lower than it's original value.
   - as the time in which maximum value of Vs(start up voltage) exceed 1700Vrms under condition of Ta= 0 °C

(4) The voltage above this value should be applied to the lamps for more than 1 second to startup. Otherwise the lamps may not to be turned on.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE
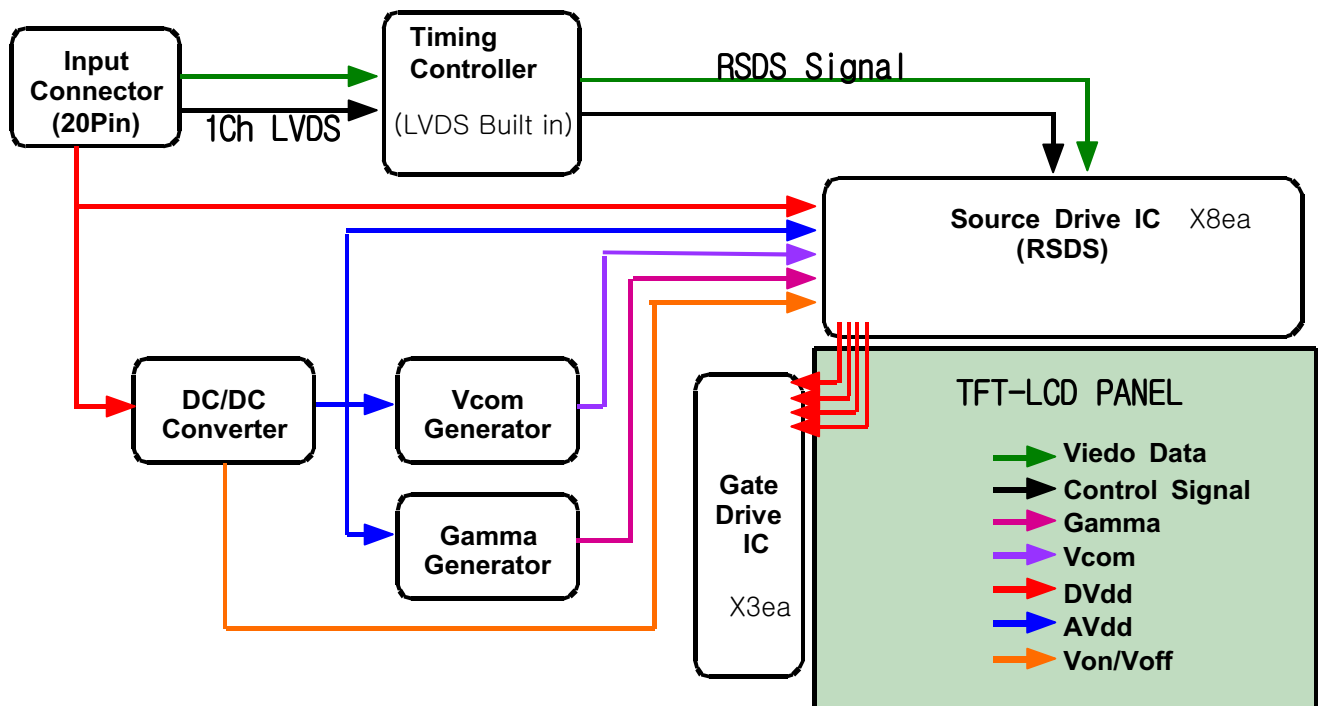
4.2 BACK-LIGHT UNIT

* Module-Side Connector : JST BHSR-02VS-1

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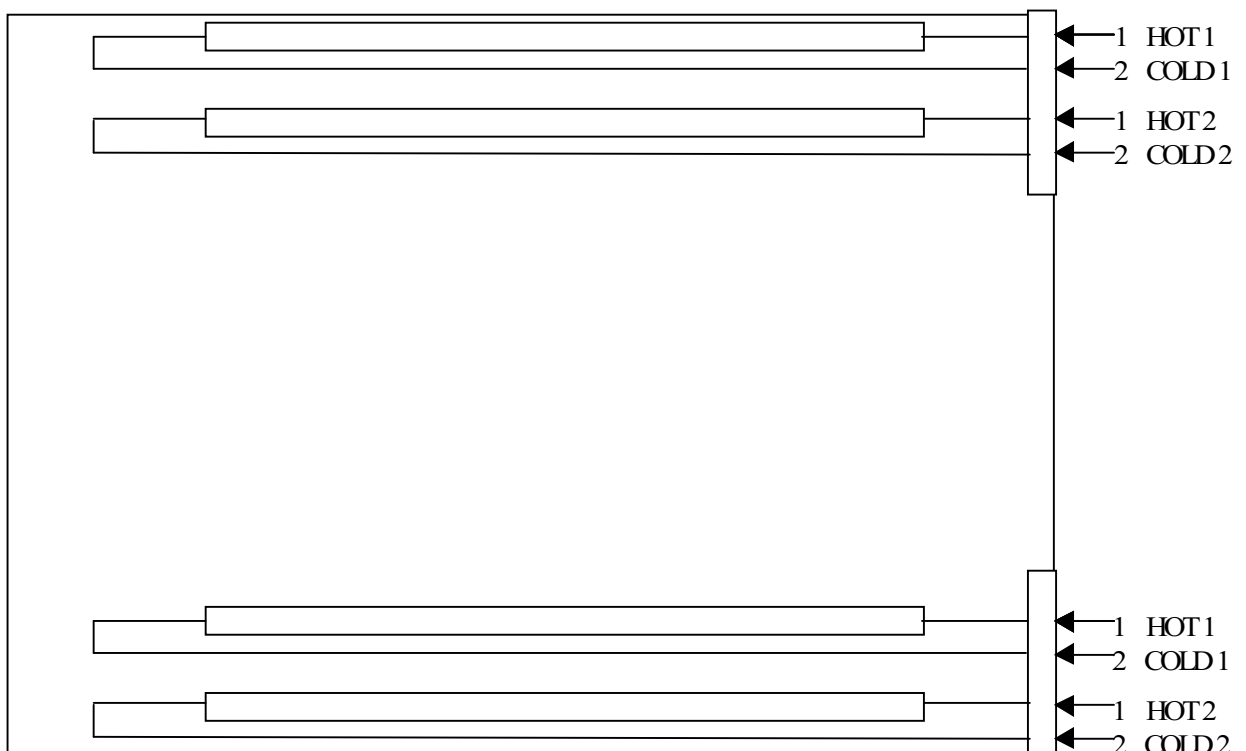
5. INPUT TERMINAL PIN ASSIGNMENT

5.1 Input Signal & Power

Connector: (DF14H-20P-1.25H / HIROSE)

Pin No.	Symbol	Function	Remark
1	VDD	Power Supply 3.3V	
2	VDD	Power Supply 3.3V	
3	GND	Ground	
4	GND	Ground	
5	RX0-	Receiver Signal(-)	
6	RX0+	Receiver Signal(-)	
7	GND	Ground	
8	RX1-	Receiver Signal(-)	
9	RX1+	Receiver Signal(-)	
10	GND	Ground	
11	RX2-	Receiver Signal(-)	
12	RX2+	Receiver Signal(-)	
13	GND	Ground	
14	RXCLK-	Receiver Clock Signal(-)	
15	RXCLK+	Receiver Clock Signal(-)	
16	GND	Ground	
17	RX3-	Receiver Signal(-)	
18	RX3+	Receiver Signal(-)	
19	GND	Ground	
20	N.C	N.C	

5.2 Inverter Output Pin Assignment

	Pin No	OUTPUT	Connector Part No.
UP	1, 3	HOT (High)	SM02B-BHSS-1-TB
	2, 4	COLD (Ground)	
DOWN	1, 3	HOT (High)	
	2, 4	COLD (Ground)	

5.3 Input Signal,Basic Display Colors and Gray Scale of Each Colors

COLOR	DISPLAY (8bit)	RED R0	R1	R2	R3	R4	R5	R6	R7	GREEN G0	G1	G2	G3	G4	G5	G6	G7	BLUE B0	B1	B2	B3	B4	B5	B6	B7	GRAY SCALE LEVEL
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
	↑	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
	:	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			R3~
	:	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			R249
	↓	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R250
	LIGHT	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R251
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R252
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1
	↑	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
	:	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			G3~
	:	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			G249
	↓	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G250
	LIGHT	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G251
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G252
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B1
	↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	B2
	:	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			B3~
	:	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			B249
	↓	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B250
	LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B251
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B252

Note) ✓ Definition of Gray :

   Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

   ✓ Input Signal : 0 = Low level voltage, 1 = High level voltage

6. INTERFACE TIMING

6.1 Timing Parameters (DE only mode)

| Signal	Item	Symbol	MIN	TYP		MAX	Unit		Note
Clock	Frequency	1 / Tc	-	68		80	MHz		
	High Time	TCH	2	-		-	nsec		
	Low Time	TCL	2	-		-	nsec		
Data	Setup Time	TDS	4	-		-	nsec		
	Hold Time	TDH	4	-		-	nsec		
Data Enable	Setup Time	TES	2	-		-	nsec		(1)
Frame Frequency	Cycle	Tv	772	16.7	806	10000	msec	lines	
Vertical Active Display Term	Display Period	TVD	768	768		768	lines		
One Line Scanning Time	Cycle	TH	1350	1408		1688	clocks		
Horizontal Active Display Term	Display Period	THD	1280	1280		1280	clocks		

Note (1) When LTM170W1-T01 model is operated by DE only mode, Hsync and Vsync input signals

should be fixed to "Low" for stable operation.

Otherwise, the module could operate abnormally.

6.2 PIXEL FORMAT
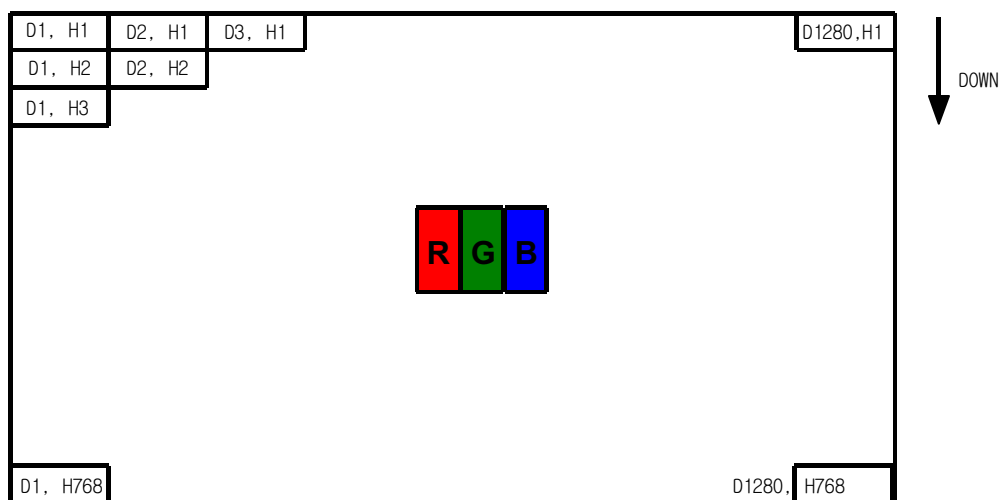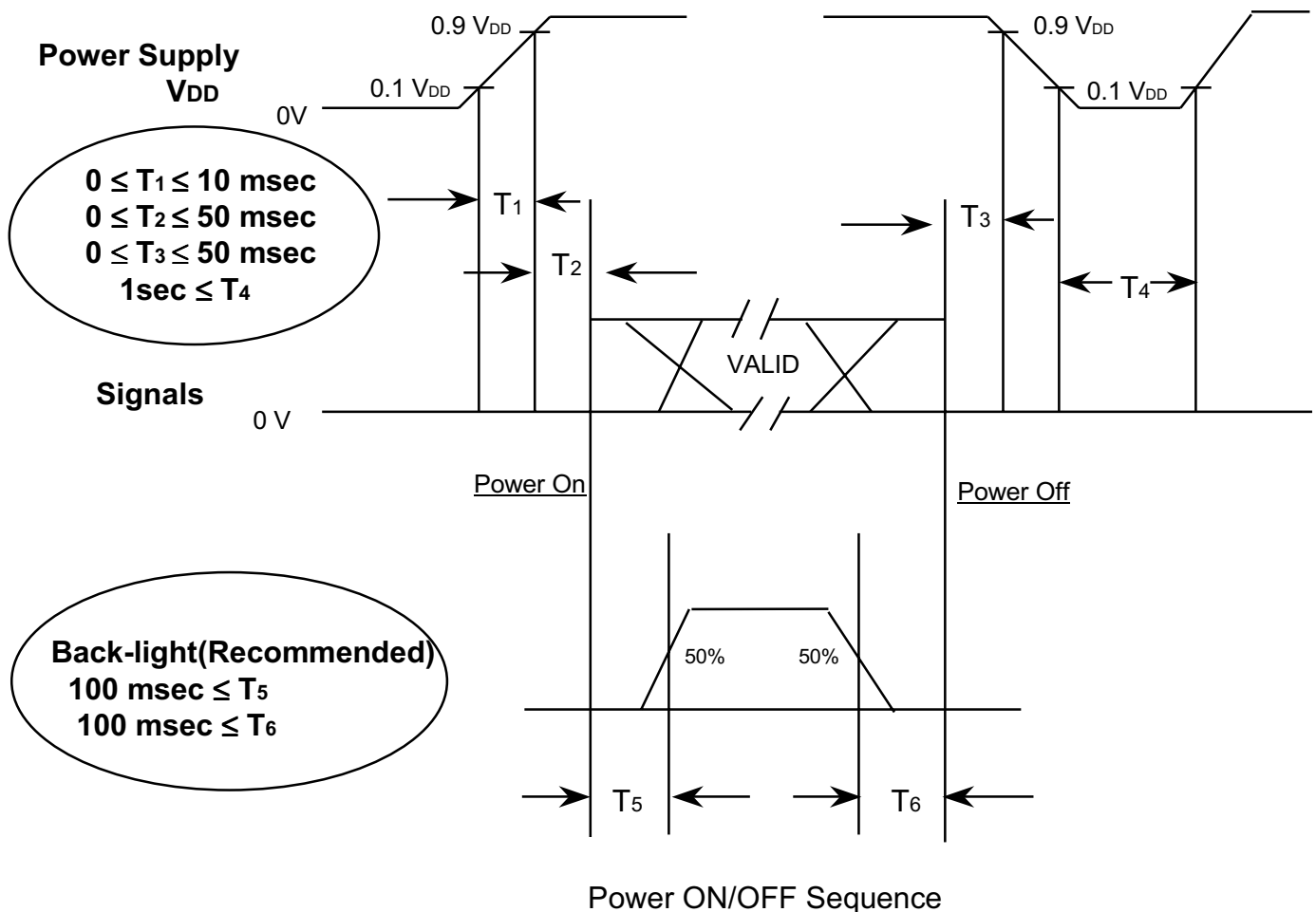

NOTE
(Dn, Hm) = # n, # m Pixel

6.3 Timing diagrams of interface signal (DE only mode)
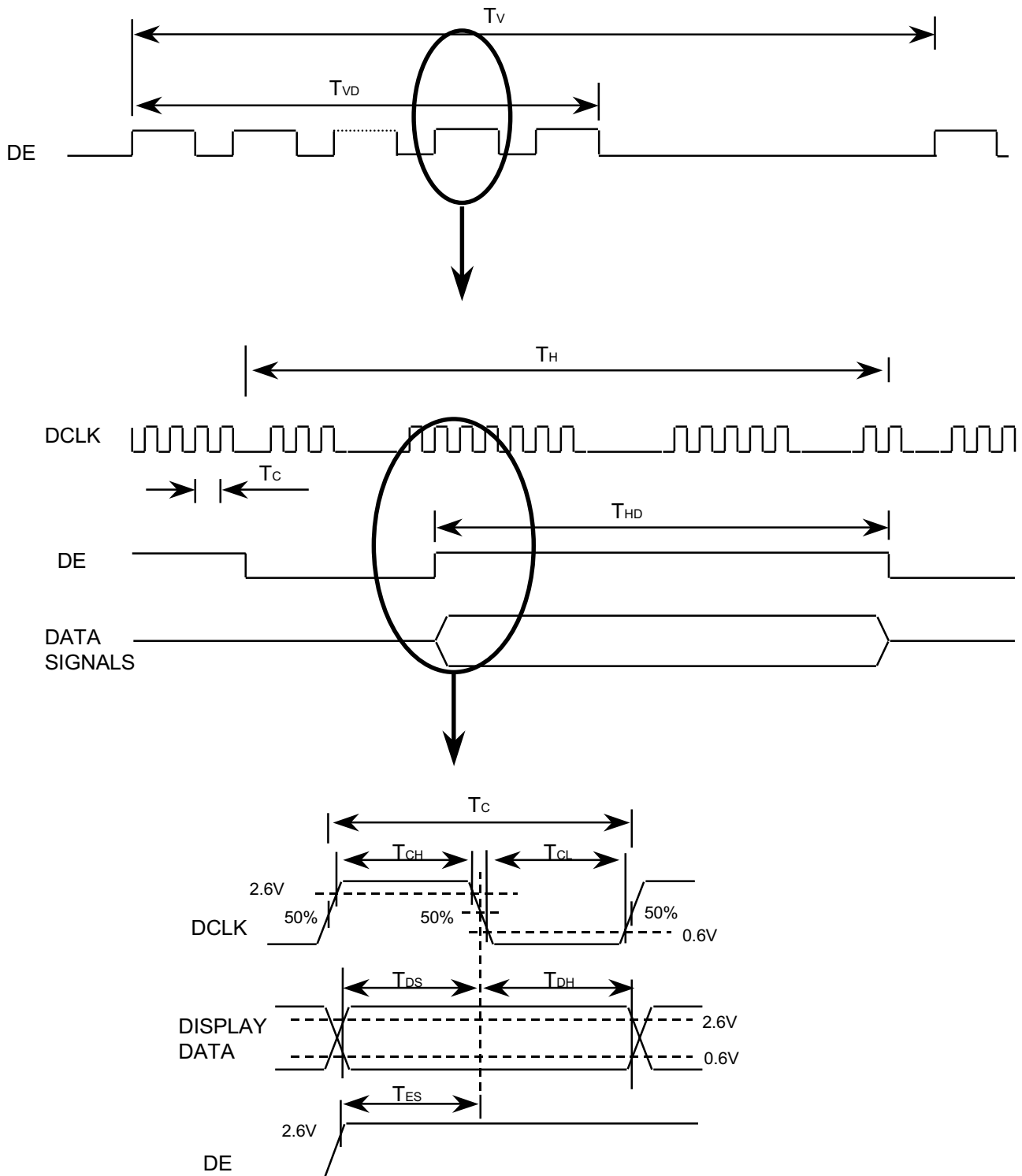
6.4 Power ON/OFF Sequence

: To prevent a latch-up or DC operation of the LCD module, the power on/off sequence
should be as the diagram below.

Power Supply
V$_{DD}$

0.9 V$_{DD}$

0.1 V$_{DD}$

0V

$0 \leq T_1 \leq 10$ **msec**
$0 \leq T_2 \leq 50$ **msec**
$0 \leq T_3 \leq 50$ **msec**
$1sec \leq T_4$

T_1

T_2

0.9 V$_{DD}$

0.1 V$_{DD}$

T_3

T_4

VALID

Signals

0 V

Power On

Power Off

Back-light(Recommended)
100 msec $\leq T_5$
100 msec $\leq T_6$

50%   50%

T_5 T_6

Power ON/OFF Sequence

NOTE.

(1) The supply voltage of the external system for the module input should be the same
as the definition of V$_{DD}$.

(2) Apply the lamp voltage within the LCD operation range. When the back-light turns on
before the LCD operation or the LCD turns off before the back-light turns off, the
display may momentarily become white.

(3) In case of V$_{DD}$ = off level, please keep the level of input signals on the low or keep
a high impedance.

(4) T4 should be measured after the module has been fully discharged between power
off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

7. OUTLINE DIMENSION
FRONT VIEW (PANEL SIDE)

BACK VIEW (BLU SIDE)

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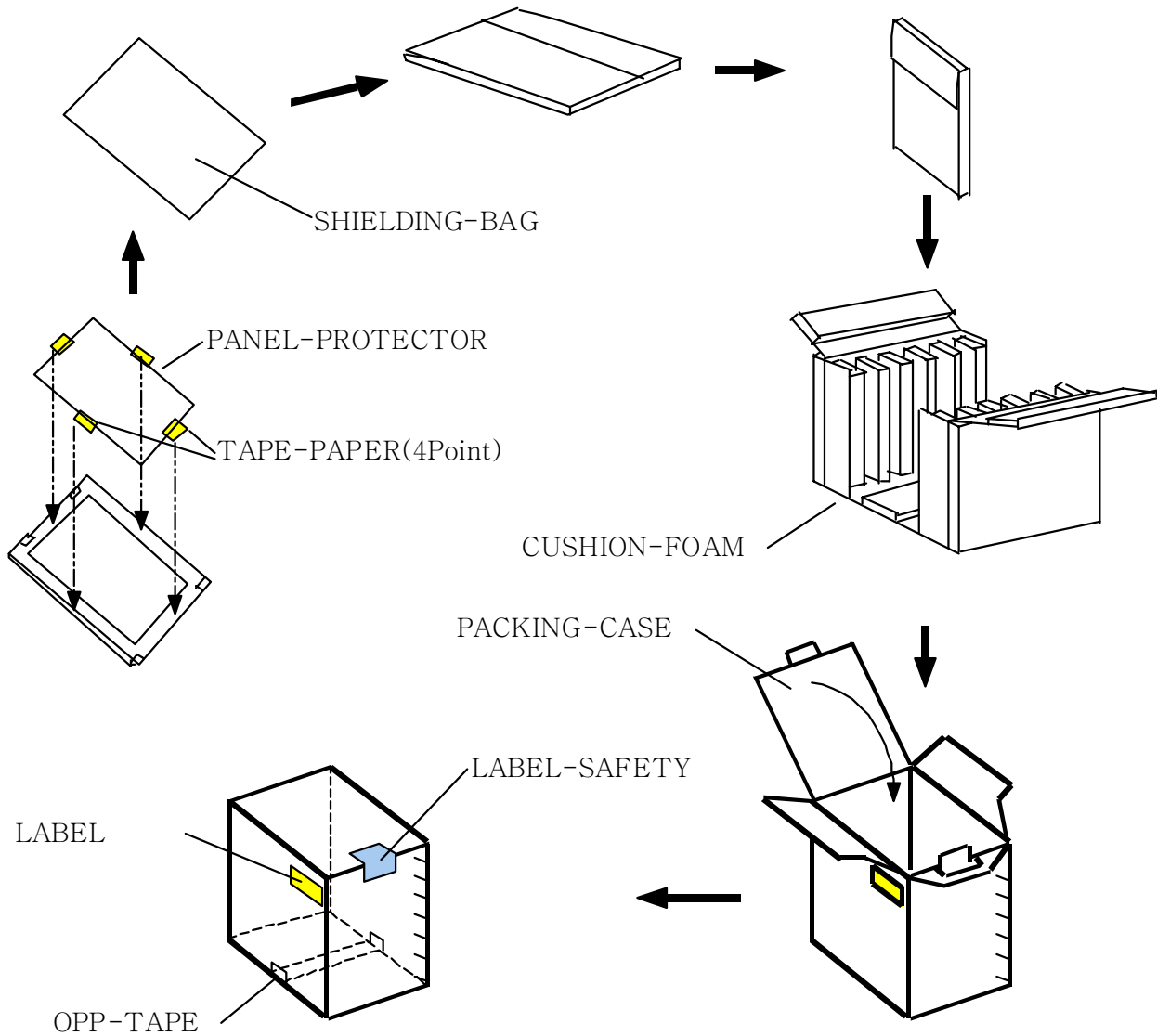## 8. PACKING

8.1 CARTON(Internal Package)

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method

SHIELDING-BAG

PANEL-PROTECTOR

TAPE-PAPER(4Point)

CUSHION-FOAM

PACKING-CASE

LABEL-SAFETY

LABEL

OPP-TAPE

NOTE) 1) TOTAL : Approx. 20.0㎏

2) Acceptance number of piling : 5sets

3) Carton size :450(W) X 348(D) X 440(H)

4) MAX accumulation quantity : 5 cartons

(3) Packing Material

No	Part name	Quantity	No	Part name	Quantity
1	PROTECTOR-PANEL	1	6	SHIELDING-BAG	1
2	TAPE-PAPER	0.2MT	7	OPP-TAPE	0.2MT
3	PACKING-CASE	0.2	8	LABEL-PAPER	1
4	CUSHION-FOAM(U)	0.2	9	LABEL-SAFETY	1
5	CUSHION-FOAM(L)	0.2	10	LABEL-BARCODE	1

9.MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

(1) Parts number : LTM170W1-L01

(2) Revision : One letter

(3) Control : One letter

(4) Lot number : 4 D 1 H 123 01 C

　　　　　　　　1 2 3 4 5 6 7

① 4 : Line
② D : Device
③ 1 : Year
④ H : Month
⑤ 123 : LOT NO
⑥ 01 : GLASS NO
⑦ C : CELL NO

(5) Nameplate Indication
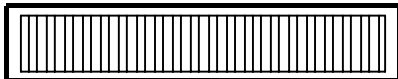
SAMSUNG LTM170W1-L01

0108

MADE IN KOREA 4D1H12301C
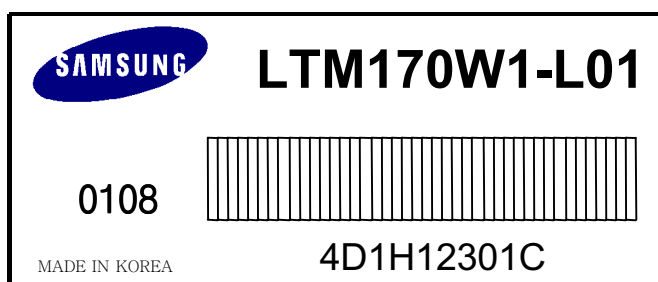
(6) Bar code marking for Customer
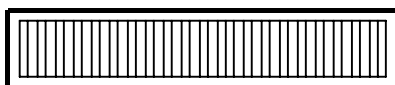
    The bar code marking is attached to module backside.

1) MODEL NAME : LTM170W1-L01
2) SAMSUNG
3) MADE IN KOREA
4) PRODUCTION NUMBER
5) USER MODEL NAME
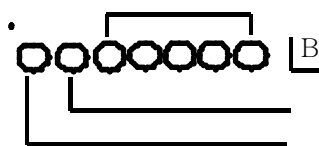
Bar code shows

    a) User model name
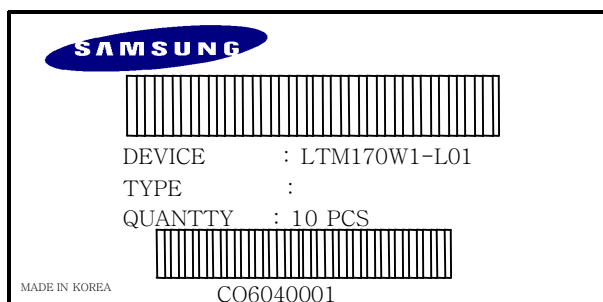   LTM170W1-L01

SAMSUNG
MADE IN KOREA

6430008B

SERIAL NO

B REVISION CODE

PRODUCTION MONTH

PRODUCTION YEAR

(7) Packing box attach

SAMSUNG

DEVICE   : LTM170W1-L01
TYPE   :
QUANTTY : 10 PCS

MADE IN KOREA   CO6040001

(8) Others
    1.After service part

Part Name	Description
ASS'Y-LAMP(U)	ASS'Y 170W1-LAMP(U)
ASS'Y-LAMP(L)	ASS'Y 170W1-LAMP(L)

10. General Precautions

10.1 Handling

(a) When the module is assembled, It should be attached to the system firmly
using every mounting holes. Be careful not to twist and bend the modules.

(b) Refrain from strong mechanical shock and / or any force to the module. In addition to
damage, this may cause improper operation or damage to the module and CCFT back-light.

(c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch
the surface harder than a HB pencil lead.

(d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time,
Staining and discoloration may occur.

(e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane.
Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl
chloride. It might permanent damage to the polarizer due to chemical reaction.

(g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or
mouth . In case of contact with hands, legs or clothes, it must be washed away thoroughly
with soap.

(h) Protect the module from static , it may cause damage to the C-MOS Gate Array IC.

(i) Use finger-stalls with soft gloves in order to keep display clean during the incoming
inspection and assembly process.

(j) Do not disassemble the module.

(k) Do not pull or fold the lamp wire.

(l) Do not adjust the variable resistor which is located on the back side.

(m) Pins of I/F connector shall not be touched directly with bare hands.

10.2 Storage

(a) Do not leave the module in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 °C and
relative humidity of less than 70%.

(b) Do not store the TFT-LCD module in direct sunlight.

(c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent
light during the store.

10.3. Operation

(a) Do not connect, disconnect the module in the " Power On" condition.

(b) Power supply should always be turned on/off by following item 6.6
" Power on/off sequence ".

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic
interference shall be done by system manufacturers. Grounding and shielding methods
may be important to minimize the interference.

(d) The cable between the back-light connector and its inverter power supply shall be a
minimized length and be connected directly . The longer cable between the back-light
and the inverter may cause lower luminance of lamp(CCFT) and may require higher
startup voltage(Vs).

10.4 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection
of electrode.

(c) Do not exceed the absolute maximum rating value. (the supply voltage variation, input
voltage variation, variation in part contents and environmental temperature, so on)
Otherwise the module may be damaged.

(d) If the module displays the same pattern continuously for a long period of time, it can be
the situation when the image "sticks" to the screen.

(e) This module has its circuitry PCB's on the rear side and should be handled carefully in
order not to be stressed.